

## SOLAR PHENOMENA.

*Sun-spots.*—The following observations, made by Mr. D. P. Todd, upon the spots on the sun, have been kindly communicated to the Signal Service by Rear-Admiral John Rodgers, U. S. N., Superintendent of the Naval Observatory:

July, 1877.	No. of new—		Reappeared by solar rotation.		Disappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
1st, 10 a. m...	0	0	1	2	0	0	2	4	
2nd, 10 a. m...	0	1	0	0	1	2	1	3	
4th, 10 a. m...	0	0	0	0	0	0	1	3	
5th, 8 p. m...	0	0	0	0	0	0	0	0	
7th, 11 a. m...	0	0	0	0	0	0	0	0	
8th, 10 a. m...	0	0	0	0	0	0	0	0	
9th, 9 a. m...	0	0	0	0	0	0	0	0	
10th, 6 p. m...	0	0	0	0	0	0	0	0	
11th, 9 a. m...	0	0	0	0	0	0	0	0	
12th, 9 a. m...	0	0	0	0	0	0	0	0	
13th, 9 a. m...	0	0	0	0	0	0	0	0	
14th, 7 a. m...	0	0	0	0	0	0	0	0	
15th, 10 a. m...	0	0	0	0	0	0	0	0	
17th, 6 p. m...	0	1	0	0	0	0	0	1	
18th, 10 a. m...	0	0	0	0	0	0	0	1	
22nd, 2 p. m...	0	0	0	0	0	0	0	0	
24th, 3 p. m...	0	0	0	0	0	0	0	0	
25th, 11 a. m...	0	0	0	0	0	0	0	0	
28th, 11 a. m...	0	0	0	0	0	0	0	0	
31st, 7 a. m...	1	5	0	0	0	0	1	5	

M. Albert Lancaster, Meteorologist Inspector in the Royal Observatory at Brussels, publishes a memoir in the "*Bulletin de l'Académie Royale*" for May, in which he makes a careful examination and comparison of the summer, winter, and annual temperatures at Brussels from 1833 to 1877, in reference to the activity of sun-spots for the same period, and draws the conclusion that the amount of heat thrown by the sun on the earth is greatest when the spots are the least in number, and that the researches of M. Köppen show the contrary during or after a period of maxima of spots; that the variations in the distribution of temperature on the globe are due, in great part, if not entirely, to the frequency of spots; that the influence of these spots are shown more clearly in low than in high latitudes; that the Gulf stream offers, after each minimum of spots, the phenomenon of a temperature much above the mean, which renders the winter and summer of Europe exceptionally warm, and that to this increase of temperature in the Gulf stream the northeastern coast of the United States is indebted to contrary north polar currents whose temperature is below the mean. As a result of his examination, he announced that the approaching summer of 1877 would have, in Europe, a temperature above the mean, and in the east of the United States a temperature below the mean.

Dr. W. W. Hunter, the Director General of the Statistical Department of India, has made an investigation of the rain-fall in the Presidency of Madras for a period of sixty-four years, with a view of determining if any relation exists between the number of sun-spots and amount of rain. He finds that, in a cycle of eleven years both sun-spots and rain-fall reach their minimum, consisting of the eleventh, first, and second years, and their maximum in the fifth year. He cautiously stated his general conclusions thus: "That while the statistical evidence discloses a cycle of drought in Southern India coincident in a marked manner with a corresponding cycle of sun-spots, it also tends to show that the average rain-fall of the years of minimum rain-fall in the said cycle approaches perilously near to the point of deficiency which causes famine; that the average is, however, above that point, and that, while we have reason to apprehend recurring droughts and frequent famines in these cyclic years of minimum rain-fall, the evidence is so far insufficient to warrant the prediction of a regularly recurring famine.

## NOTES AND EXTRACTS.

Prof. E. Loomis communicates to the American Journal of Science the following conclusions:

[Continued from the Review of June.]

4. In North America, south of latitude  $35^{\circ}$ , areas of low pressure are less frequent and generally exhibit a less depression than near latitude  $45^{\circ}$ , because the area over which a cyclonic movement of the winds prevails is small; and this area is small because if a cyclonic area could be formed having a radius of 1,000 miles with its centre in latitude  $30^{\circ}$ , its circumference must extend southward to latitude  $16^{\circ}$ , where the trade winds are steady and seldom interrupted. Such a diversion of the winds toward the north, even if it could be produced, could not be long maintained; so that a large cyclonic area with its centre in latitude  $30^{\circ}$  is well nigh impossible; and it is impossible that there should be a great depression of the barometer in latitude  $30^{\circ}$ , except with a wind having a hurricane velocity. This is believed to be the reason why in North America the centres of great storms are generally found north of latitude  $40^{\circ}$ .

5. The causes which may produce a general movement of the atmosphere toward a central area are (A) unequal pressure as shown by the barometer; (B) unequal temperature; and (C) unequal amount of aqueous vapor. Of these three causes the effect of the first is generally so decided that the influence of the other two causes can only be detected by careful observation; but when the pressure of the air is nearly uniform over a large extent of country, the influence of the other two causes is sometimes very palpable, and their influence is generally seen in a slight deflection of the winds from the direction they would have if wholly controlled by the first cause. I have made a considerable collection of facts illustrating the influence of temperature upon the direction of the winds, which I intend to publish hereafter.

6. A cyclonic movement of a large mass of air is generally attended by an upward motion in certain localities, chiefly on the eastern side of the centre of low pressure, and this upward movement results in rain-fall. The rain-fall is then not generally the original cause of the barometric depression, but rather an incident of the cycloidal movement of the atmosphere. The fall of the barometer during a rain-storm cannot be ascribed to the simple condensation of the vapor of the atmosphere, as some have supposed, since a rain-fall of one or two inches prevailing over an area of 300 miles in diameter near latitude 30° produces scarcely an appreciable effect upon the barometer.

7. The progress of areas of low barometer in all latitudes is determined mainly by the same causes which determine the general system of circulation of the atmosphere; and their normal direction is changed by whatever causes may change the direction of the winds.

8. The heat which is liberated in the condensation of a large amount of aqueous vapor must exert an influence upon the movements of the air, so that while the rain is generally to be regarded not as the original cause but rather as one of the incidents of extensive cycloidal movement, if the rain-area has great geographical extent, it may have a decided influence upon the amount of the barometric depression and upon the velocity with which the storm advances; sometimes accelerating its motions, sometimes retarding it, and sometimes holding it nearly stationary in position for two or three days.

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